An optical scanning subsystem for a UAS-enabled hyperspectral radiometer (AirSHRIMP)

Completed Technology Project (2013 - 2014)

Project Introduction

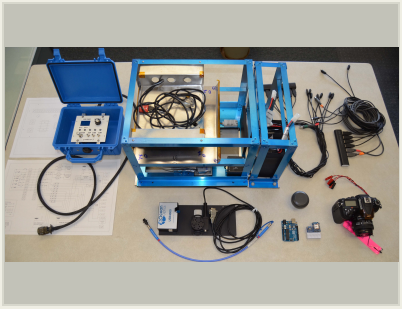
Hyperspectral radiometers will be integrated with an optical scanning subsystem to measure remote sensing reflectance spectra over the ocean. The entire scanning radiometer system will be integrated into an unmanned aircraft system (UAS) to allow for remote sensing and for support of real time validation opportunities. Maps of hyperspectral imagery will be telemetered to a data visualization application for monitoring the progress of UAS surveys.

A hyperspectral visible radiometer instrument system has been developed for use on UAS platforms. It has been successfully flown on three previous UAS field campaigns, and recently integrated for flight on board MIZOPEX a fourth. In all of these experiments, the radiometer was configured in a fixed-look scan angle mode that allowed for observing along a single fixed track, and the science data were recorded internally on board the UAS and only made available upon the successful return of the UAS and its payload. The focus of this project is to expand upon the present UAS capability for observing hyperspectral reflectance spectra. By integrating a scanning subsystem and a remote telemetry capability, we will enable science investigator(s) to modify the scanning configuration in order to optimize the science data collection in a specific region in the cross-track domain.

A hyperspectral radiometer instrumentation will be integrated into a scanning subsystem in order to allow the radiometer to scan across a range of angles as the UAV progresses along in its survey. The configuration will consist of a series of lower spectral resolution radiometers that will be set to cross-track scan angles, a higher spectral resolution radiometer with a cosine collector set to zenith for measuring the downward radiance spectra, and a second higher resolution radiometer mounted to a servo motor for scanning along a cross-track scan angle that can either be preset or controlled remotely. Real time spectral observations will be downscaled to send the spectra to a downlink computer in near real time. These observations would then be available for re-tasking the scanning component of the radiometer.

The ability to collect reflectance spectra of the ocean surface in real time can help scientists optimize their data collection strategies. Optimization of data collection has become a growing area of research, especially for scienctists who are faced with collecting science data in a regions that have small space and time scales of variability. This problem is also one of concern for UAS-enabled science instruments that would prefer to set their observational focus as a function of the observed spatial variability, allowing more observations to be collected along features of interest and less within areas that show little variability. Such observing strategies lend well to 2D spatial mapping algorithms such as optimal interpolation.

The present radiometer instruments and software is easily portable to a system configured with multiple radiometers. The two major technical aspects of this project will be in regard to the control of the pointing system and with



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the real time data telemetry link.

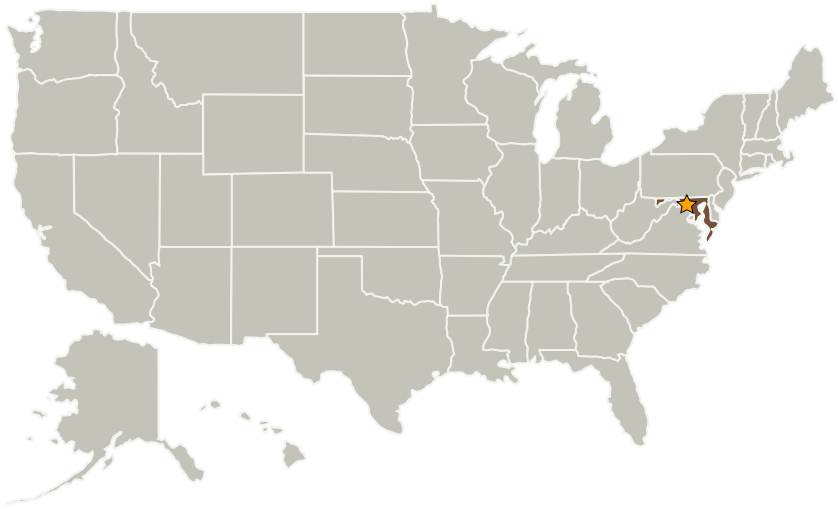
Anticipated Benefits

This instrument resulting from this project will be of use for collecting observations of remote sensing reflectance spectra for validation activties and can alse be used to support science field missions.

This instrument resulting from this project will be of use for collecting observations to support the development of algorithms for satellite missions.

While NASA is the lead agency for remote sensing satellites, NOAA is currently developing (with NASA's support) missions to provide operational forecast quality observations. This instrument can be used to collect observations to support validation efforts.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

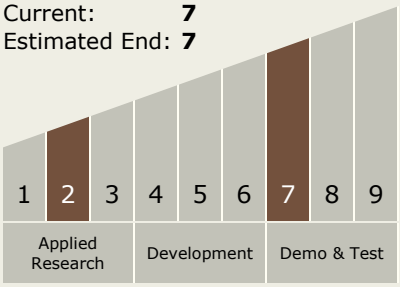
Matt Mcgill

Principal Investigator:

John R Moisan

Technology Maturity (TRL)

Start: **2**
Current: **7**
Estimated End: **7**



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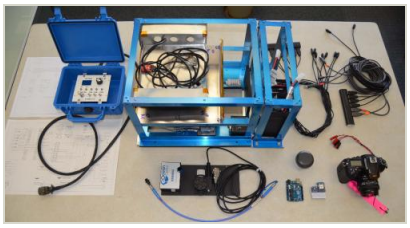
Images



An optical scanning subsystem for a UAS-enabled hyperspectral radiometer Project (AirSHRIMP)
An optical scanning subsystem for a UAS-enabled hyperspectral radiometer Project (AirSHRIMP) *(https://techport.nasa.gov/image/4078)*

Project Website:

http://aetd.gsfc.nasa.gov/

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves